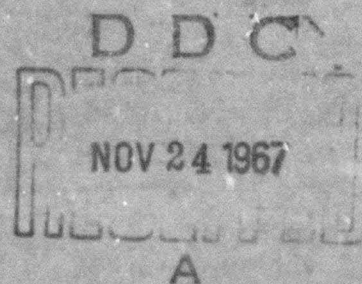


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Ratings of Air Route Traffic Control Specialists**

June 1967



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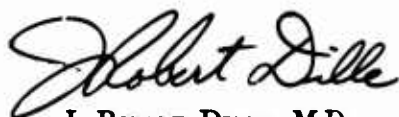
**OFFICE OF AVIATION MEDICINE
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION**



**THE RELATIONSHIPS BETWEEN CHRONOLOGICAL AGE,
LENGTH OF EXPERIENCE, AND JOB PERFORMANCE
RATINGS OF AIR ROUTE TRAFFIC
CONTROL SPECIALISTS**

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The opinions and conclusions contained in this report are those of the author and should not be construed as reflecting the views or endorsement of the Federal Aviation Administration.

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THE RELATIONSHIPS BETWEEN CHRONOLOGICAL AGE, LENGTH OF EXPERIENCE, AND JOB PERFORMANCE RATINGS OF AIR ROUTE TRAFFIC CONTROL SPECIALISTS

I. Introduction.

Aviation has been developing and expanding at an increasingly accelerated pace in recent years.. Pilot certification has more than doubled within the past 5 years, aircraft production is some 40 per cent greater than 2 years ago, and new records in revenue for both passengers and freight are being established each year. The growing numbers of aircraft, varied in type and with higher speed capabilities, have resulted in increasingly heavier traffic loads for both the Terminal (or Tower) and Air Route (or Center) traffic control facilities of the Federal Aviation Administration (FAA).

However, the FAA anticipated this greater volume of traffic and through advanced planning, research, and development has been able to improve significantly the capability and reliability of the numerous elements of the air traffic management system. Progressive improvements have been made in regard to communications, surveillance gear, and various types of ancillary equipment; traffic control procedures and flight regulations have been revised to promote a more expeditious flow of air traffic with an enhanced margin of safety; higher standards have been implemented for the selection of controller trainees, and changes in training programs have been instituted.

The typical journeyman controller of today can more easily and effectively direct greater numbers of aircraft than his predecessor. Yet, his job continues to be of a very demanding and critical nature. The imperativeness of safety in traffic operations requires that a controller remain alert over long periods of time, always capable of making precise error-free decisions. In crucial situations, he must maintain emotional stability and react in a calm, yet speedy, and technically approved manner. A controller must

keep fully abreast of all changes and updating in procedures and be able to pass frequent periodic proficiency checks. It is also important that he develop and retain an adaptability and resiliency to variable day-night work shift changes or patterns. Briefly, the job of an Air Traffic Control Specialist (ATCS) is apt to be described by a knowledgeable observer or by the controller himself as being "stressful."

In recent years, officials have expressed a growing interest and concern regarding the extent to which controller performance and reactions to stress might be associative with aging and length of experience in active control work. This concern has been based partially upon anecdotal evidence and also upon previous research findings, some of which represented peripheral findings of investigations designed for other purposes. However, the need for a more definitive study of the interrelationships of age, experience, and performance became increasingly more apparent. Research efforts for this purpose were undertaken in 1965 by the FAA's Civil Aeromedical Institute (CAMI) in Oklahoma City.

The present report pertains to but one of the project's two basic phases. More specifically, the phase encompassed in this report represents a survey-type study involving the collection of experimentally derived ratings of job performance for several hundred Air Route (or Center) journeymen radar ATCSs and the relationships of these criterion measures to chronological age and tenure in ATC work.

II. Methodology

The investigative procedure for the overall research project was formulated on the assumption that both "subjective" and "objective" evaluations of controller proficiency should be collected for use as performance criteria. At the outset, how-

ever, it was noted that the existing and available subjective evaluations were somewhat inappropriate for the purpose. Appraisal methods in use at the time the study was initiated had been designed primarily for remedial and diagnostic purposes. Most of these operationally derived evaluations were also nonquantitative and offered little potential for individual differentiation. In quest of more adequate "subjective" criteria, three experimental performance-rating procedures were developed. Each procedure involved a different form or evaluation format. These forms, which are described in subsequent sections of this report, were designated as "Form A, Nominations by Coworkers," "Form B, Supervisory Rating of Performance," and "Form C, Supervisory Rating of Performance."

Several different methods were considered whereby "objective" measures of performance might be obtained. The need for standardized evaluation procedures was recognized, and it became apparent that traffic-control-problem-simulation equipment would be involved. It was concluded that the equipment and experienced personnel of the National Aviation Facilities Experimental Center (NAFEC) would afford the best means of obtaining such indices. After proper coordination, a project was established by NAFEC for intensive simulation testing of 36 ATCSs who would be randomly selected from specific age and experience groups of several hundred controllers for whom CAMI would collect "field" ratings (i.e., supervisory ratings and peer ratings) of job performance. The results of the NAFEC testing phase are not included in the present report.

Arrangements for the Collection of Field Ratings. The collection of data on controller personnel of four major Air Route Traffic Control Centers (ARTCCs) was coordinatively arranged by the FAA Headquarters' Office of Personnel and Training (OPT) and the Air Traffic Service (ATS). The facilities involved are located at or near Atlanta, Georgia; Memphis, Tennessee; Leesburg, Virginia; and Ronkonkoma, New York.

With the cooperation of each facility chief and his staff, schedules were arranged whereby approximately 95 per cent of controller personnel received an oral briefing in which a visiting member of the CAMI research team discussed the types of information to be collected and some

of the objectives of the study. The controllers were informed that the Office of Aviation Medicine had been requested to conduct a survey to determine the various methods by which controller proficiency might be evaluated, and also to obtain information from controllers regarding the work environment and other factors which they deemed relevant to performance. The researcher explained that a person's health, age, training, knowledge, and experience represented only a few of the possible determinants of individual performance. Working conditions, administrative policies, and work-shift changes were also mentioned as being of possible import. Due to the possibility of bias that might otherwise have arisen, efforts were made to avoid any focus upon age and experience.

In discussing the different types of data to be collected from both the controllers and their supervisors, the researcher emphasized that all of the information would be collected on an anonymous basis, that no signature would be required with the submission of any form or rating, and that all of the data would be used only for research purposes.

Coworker Nominations Form A. Each Assistant Controller, Journeyman Radar ATCS, E-Coordinator, and Crew Chief received a copy of the Form A. It was explained that the nominations form offered each of them an opportunity to contribute toward identification of the best controllers within the entire facility. Nominations submitted by a controller were not restricted to those of his own GS-level or job position. In brief, the recipient of each Form A was merely requested to nominate those individuals whom he considered as "most outstandingly effective" in the performance of duties for each of three positions. The positions were "Sector, D-Interphone/Radio," "R-Radar Position," and "E-Coordinator." It was suggested that nominations of this category be limited to four for each position and that any additional names be listed in a second category designated as "next most effective." In the derivation of summary scores, the data processing staff assigned a weight of 2 for each of the four nominations listed as "most outstandingly effective." Of all remaining nominations in either category, the fifth, sixth, seventh, and eighth were each assigned a weight of 1. Those beyond the eighth were omitted. An individual's coworker-nominations score for a given position

was simply the sum of the weighted nominations he received. Several controllers within each facility received no nominations of any sort. For each position, the nominations scores were then T-scaled, separately by each of the four facilities, to yield a distribution of ratings having a mean of 50 and a standard deviation of 10. Various combinations of the D, R, and E nominations were also derived by averaging the T-scores for the different positions. Even though it is true that the Radar ATCSs occasionally do some work at each of the three job stations, the "R" position may be considered as the "home" position. Therefore, the "R"-nominations score was deemed as

being more meaningful and appropriate for the Journeymen Radar Controllers.

Supervisory Ratings By Form B and Form C.

The two instruments developed for supervisory rating of controller performance were designated as "Form B" and "Form C." Although these experimental rating forms differed in several respects, both embodied the same five-point rating scale (i.e., 0=Unsatisfactory, 1=Fair, 2=Good, 3=Very Good, and 4=Excellent). Each form provided for the evaluation of an ATCS on numerous items, each of which represented an attribute, element, or standard of performance. The majority of the Form B items and all of

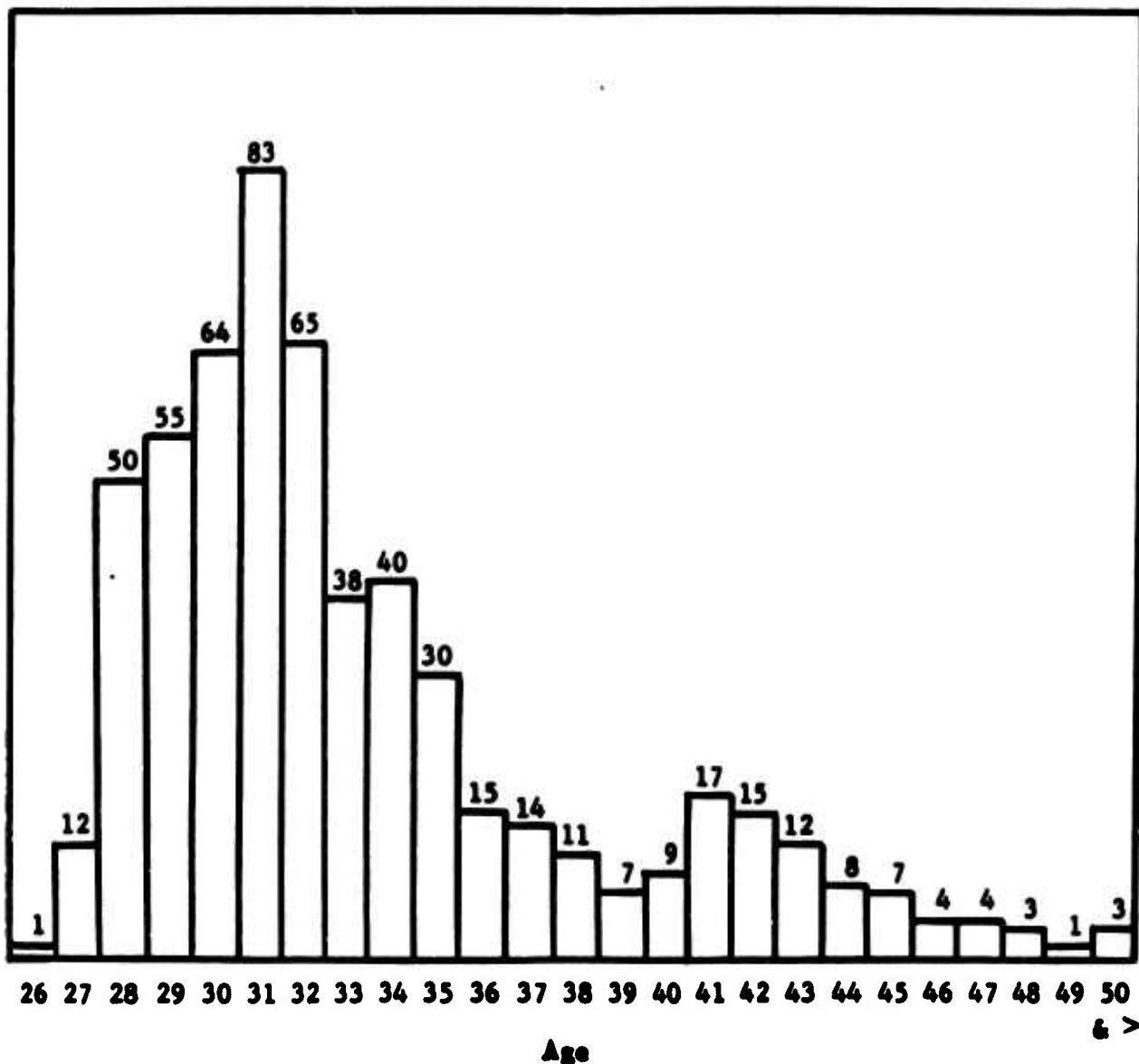


FIGURE 1. Frequency Distribution of Ages for Journeymen Radar ATCSs of the Atlanta, Memphis, Ronkonkoma, and Leesburg ARTCCs.

those in Form C had been extracted from previous appraisal instruments. The 14 items of Form B were of a more general nature and less technical than those of Form C. Form B focused upon measures of general abilities such as understanding, judgment, teamwork, cooperation, knowledge, and emotional stability. Each of the 33 items of Form C represented verbatim copy of the "performance indicators" or appraisal standards specified in the semi-annual "Over-the-Shoulder-Rating" of each controller. As previously mentioned, the latter type of proficiency evaluation and other operational appraisals, are of a non-quantitative nature and are generally used for diagnostic and remedial purposes. For construction of the Form C, the 33 technical elements or items of performance were merely adapted to the five-point rating scale format so as to yield quantitative indices of proficiency.

Completion of both a Form B and a Form C was requested of each Radar ATCS's immediate supervisor. Inasmuch as controllers frequently worked different shifts, other and/or higher supervisory personnel were also asked to submit evaluations by both forms for those controllers of whom they deemed themselves knowledgeable. Thus, two ratings of performance by each form were collected for about half the controllers, and as many as three were obtained for a few. In using either Form B or Form C, the supervisor rated an employee on each of the listed items. The average rating across all items of a submitted form was computed by the research processing staff. Dual and triple ratings were averaged to obtain a controller's overall Form B Rating and his overall Form C Rating.

III. Results

Records revealed that a total of 568 individuals were working within the four ARTCCs as GS-12 Journeymen Radar "R" Controllers. April 15, 1965, was used as the computation date for years of ATC experience and age. One of the 568 was 51 years old and two were 50. One was only 26. Within this range, the frequencies represented a skewed distribution. Only 15 were beyond age 45 and 438 were younger than 36. Assuming that the sample is representative of all Center facilities, one would conclude that about 77 per cent of the FAA's Air Route Journeymen Radar Controllers are not yet 36 years

old. The sample yielded a mean age of 33.3 and a standard deviation (S.D.) of 4.9.

An examination of the entry-on-duty (EOD) dates for these 568 ATCSs revealed that only 47 (or about 8 per cent of the sample) had been in active control work for 10 or more years. A total of 515, or approximately 91 per cent, entered service during the 4-year period 1956-1959 and thus had 6 to 9 years of experience. The remaining 6 individuals had been in ATC work for 5 years or less, a nominal period for attainment of journeyman status. The average for the 568 was 7.8 years active control work; the S.D. was 2.0.

Table I presents the distribution of years of job experience for controllers comprising each of five age groups. Addition of the frequencies would indicate that 462 of the 494 controllers aged 40 or less possessed 6 to 9 years of experience. In other words, over 81 per cent of the 568 ATCSs were not only less than 41 but also

TABLE I. DISTRIBUTION OF ATC EXPERIENCE BY AGE GROUPS

Age Groups	Year of Entry on Duty With FAA							Total
	1960						1954	
	6 >	1959	1958	1957	1956	1955	6 <	
	Length of Experience							
	5	6	7	8	9	10	11	
	6 <	Yrs.	Yrs.	Yrs.	Yrs.	Yrs.	6 >	
46 & over			2	3	3		7	15
41 - 45		7	18	15	5	6	8	59
36 - 40		7	23	6	10	5	5	56
31 - 35	2	20	90	70	58	15	1	256
30 & less	4	59	78	26	15			182
All Ages	6	93	211	120	91	26	21	568

had entered service during the FAA's rapid expansion period 1956-1959. Further examination would show that 416 of those with EOD dates of 1956 through 1959 had not yet reached their thirty-sixth birthday; this represents about 73 per cent of the entire sample. From a research standpoint, such sampling characteristics posed certain difficulties in the assessment of age and experience effects. However, the need for resolving this issue becomes more fully apparent when considering the possible impact of future en masse increments in both age and experience for such a large bloc of journeymen controllers. As will be discussed in subsequent sections of this report, several factors have arisen in recent years which suggest that these employees might experience somewhat more difficulty than their predecessors in the attainment of promotions to supervisory status. In brief, this large group

of controllers will undoubtedly continue to comprise the major portion of the journeyman air route traffic controller population for at least several, and possibly many, years.

A total of 812 Form B's and 800 Form C's was collected for the Radar ATCSs. Multiple ratings were not uncommon. In respect to Form B, 46 of the controllers received three evaluations, 241 were rated twice and 284 were rated only once. For Form C, there were 46 triplets, 238 duals and 278 singles. In all, 526 of the 568 controllers were rated at least once with either a Form B or C. (The remaining 42 ATCSs received no B nor C ratings.) Inasmuch as the forms were unsigned, multiple ratings were arbitrarily designated as the "first," "second," and "third." Pearson product-moment correlations of .46, .26, and .41 were found between the different sets of Form B ratings. Intraclass correlation techniques indicated the average of these intercorrelations to be in the order of .35. For Form C, the intercorrelations were .33, .17, and .26 and the intraclass correlation was .29. These values, which were somewhat lower than had been anticipated, should not be considered as conventional reliability coefficients. In those instances where an individual was the recipient of multiple ratings, only one represented an evaluation by his immediate supervisor; others were by other supervisory personnel who may have been less knowledgeable regarding the individual's proficiency. In retrospect, it became obvious that the procedure should have included the collection of such ratings from only the immediate supervisors. Almost 65 per cent of the Form B's and Form C's represented multiple ratings. It should also be pointed out that a rather strong "halo" effect characterized the ratings obtained with either form.

For each of 525 individuals, an Overall (Raw-Score) Form B Rating was computed by averaging the item ratings of the single or multiple forms. Similar treatment of the Form C data resulted in the assignment of 516 Overall Form C Ratings. The assigned B and C ratings were then converted to T-scaled scores yielding a mean of 50 and an S.D. of 10. The procedure not only permitted a more direct comparison of the B and C ratings with each other and with the R-Nominations score but also the averaging of T-scaled values for derivation of two composite scores which were designated as "B+C" and

"B+C+R." Thus a total of five ratings—all in T-score form—were available for use as criterion measures.

The interrelationships of the five performance measures were next determined. These Pearson coefficients, which are shown in Table II, ranged from .84 to .96 for the B, C, and B+C supervisory ratings. Correlations of the R-Nominations score with B, C, and B+C were .56, .50, and .55, respectively. Because of their magni-

TABLE II. INTERCORRELATIONS OF FIVE PERFORMANCE MEASURES AND THEIR CORRELATIONS WITH AGE AND YEARS ATC EXPERIENCE

Variables		C	B+C	R-Nom	B+C+R	Chron. Age	Experience
B-Supv. Rating	N r	515 .84	525 .96	525 .56	525 .92	525 -.14	525 -.05
C-Supv. Rating	N r		516 .95	516 .50	516 .90	516 -.15	516 -.03
B+C Supv. Rating	N r			526 .55	526 .95	526 -.15	526 -.05
R-Nomina. By ATCs	N r				526 .78	568 -.19	568 -.02
B+C+R Combined	N r					526 -.18	526 -.04
Chron. Age	N r						568 .45

tude, the latter coefficients were suggestive of both communalities and differences in regard to the factors underlying the peer ratings and the supervisory evaluations of performance. All correlations of the composite B+C+R versus the B, C, and B+C ratings were above .90, and a .78 was obtained between this composite and the R-Nom rating.

Low but statistically significant and negative correlations were found between chronological age and all five performance ratings. (See Table II.) Based on variable N's of 516 to 568, the coefficients ranged from a minus .14 to a minus .19. These statistically significant relationships, which had emerged for a sample in which almost 75 per cent of the subjects represented a narrow age range of 28 to 35 years, indicated the need for other types of analyses whereby the performance of the few older controllers might be directly compared with that of the younger groups.

Length of experience in FAA control work was also negatively related to each of the five criterion ratings. In each instance, however, the relationship was negligible and nonsignifi-

cant. For years of experience versus chronological age, the correlation was .45.

Numerous other statistical procedures, including one-way analyses of variance, were employed to determine more fully the extent to which performance—as measured by each of the five experimental ratings—might be associative with age and experience. For most of these additional investigative phases, coarse grouping procedures were employed to establish age and experience groupings. Differing numbers of class intervals were tried. In view of the skewed distributions however, five age and five experience groups were deemed most practical. All analyses of a given type yielded similar results for each of the five performance measures and the findings across the different analyses tended

to be consistent and non-contradictory. Subsequent portions of this report have therefore focused upon a discussion of the general findings obtained for only three of the five variables.

Age Versus Performance. Table III presents the means of three performance measures by age and experience groups. For the B+C Combined Supervisory Rating, the R-Nominations Score and the B+C+R Overall Rating, the means or averages in performance level reflect a progressive and steady decline from the youngest to the oldest group of ATCSs. In every instance, the t-tests indicated statistical significance of differences involving either of the two oldest versus the two youngest groups. All other differences, between adjacent age groups and those involving the intermediate age group "36-40," were not

TABLE III. MEANS OF THREE PERFORMANCE MEASURES BY AGE AND EXPERIENCE GROUPS

		Year of Entry on Duty With FAA											
		1959 & >		1958		1957		1956-1955		1954 & <			
		Length of Experience											
		6 Years or less		7 Years		8 Years		9 - 10 Years		11 Years or more			
Age Groups		N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
B+C Combined	46 & over			1	39.0	3	44.3	3	48.0	6	43.0	13	44.2
	41 - 45	6	48.3	17	47.8	13	49.0	10	43.9	7	46.1	53	47.2
	36 - 40	7	47.7	21	46.7	6	54.3	15	49.4	5	55.2	54	49.2
	31 - 35	20	47.1	85	50.2	65	50.4	68	50.9			238	50.2
	30 & less	57	52.6	73	49.8	24	52.7	14	49.8			168	51.2
	All Ages	90	50.7	197	49.4	111	50.8	110	49.9	18	47.6	526	50.0
R-Nominations	46 & over			2	48.5	3	43.0	3	46.3	7	42.7	15	44.3
	41 - 45	7	45.7	18	45.3	15	48.4	11	49.6	8	43.4	59	46.7
	36 - 40	7	47.0	23	46.3	6	53.3	15	52.8	5	48.6	56	49.1
	31 - 35	22	45.5	90	49.9	70	52.3	73	52.7	1	60.0	256	51.0
	30 & less	63	50.6	78	51.1	26	51.7	15	53.5			182	51.2
	All Ages	99	48.9	211	49.5	120	51.5	117	52.4	21	45.2	568	50.3
B+C+R Overall	46 & over			1	42.0	3	44.3	3	47.7	6	43.5	13	44.5
	41 - 45	6	47.3	17	47.4	13	49.1	10	45.9	7	46.1	53	47.3
	36 - 40	7	47.9	21	46.6	6	53.7	15	50.3	5	52.6	54	49.1
	31 - 35	20	46.8	85	50.1	65	51.1	68	51.5			238	50.5
	30 & less	57	52.0	73	50.1	24	51.1	14	50.9			168	51.1
	All Ages	90	50.2	197	49.5	111	50.1	110	50.6	18	47.1	526	50.1

statistically significant. Perhaps it should be emphasized that these are general findings based on group means. In fact, some of the controllers over 40 years of age were rated relatively high by both their peers and their supervisors whereas the opposite was true regarding some of the younger ATCSs.

Length of Experience Versus Performance. With the exception of the R-Nomination rating, no significant differences in performance were found between the groups of controllers having differing lengths of ATC job experience. However, a comparative study or plot of the data appearing in Table III would reveal a consistent trend in the group means of every rating. In each instance, the mean rating for the controllers having 11 or more years of experience is lower than for any of the less experienced groups. Yet, it should be emphasized that these means are based upon relatively small numbers of individuals, many of whom are over 40 years of age. It is also possible that many of these ATCSs have always been less proficient than

their colleagues and thus have failed to be promoted from journeyman status.

Excluding the shortest-tenure groups (for which one may only speculate regarding the relatively high ratings, such as possible recency of promotion to journeyman status), the highest performance means on every variable are for those controllers having 8 and 9-to-10 years of experience. This trend in the data is somewhat more accentuated for the R-Nominations variable. With the exception of adjacent experience groups, most of the differences between the group means of these peer ratings were found to be statistically significant.

Interaction Effects of Age and Experience. One of the basic objectives of the study concerned a determination of possible interaction effects of age and experience upon performance. Unfortunately, limitations stemming from the frequency distributions of age and experience precluded the application of many of the more sophisticated and normally appropriate statistical techniques such as "two-way analysis of

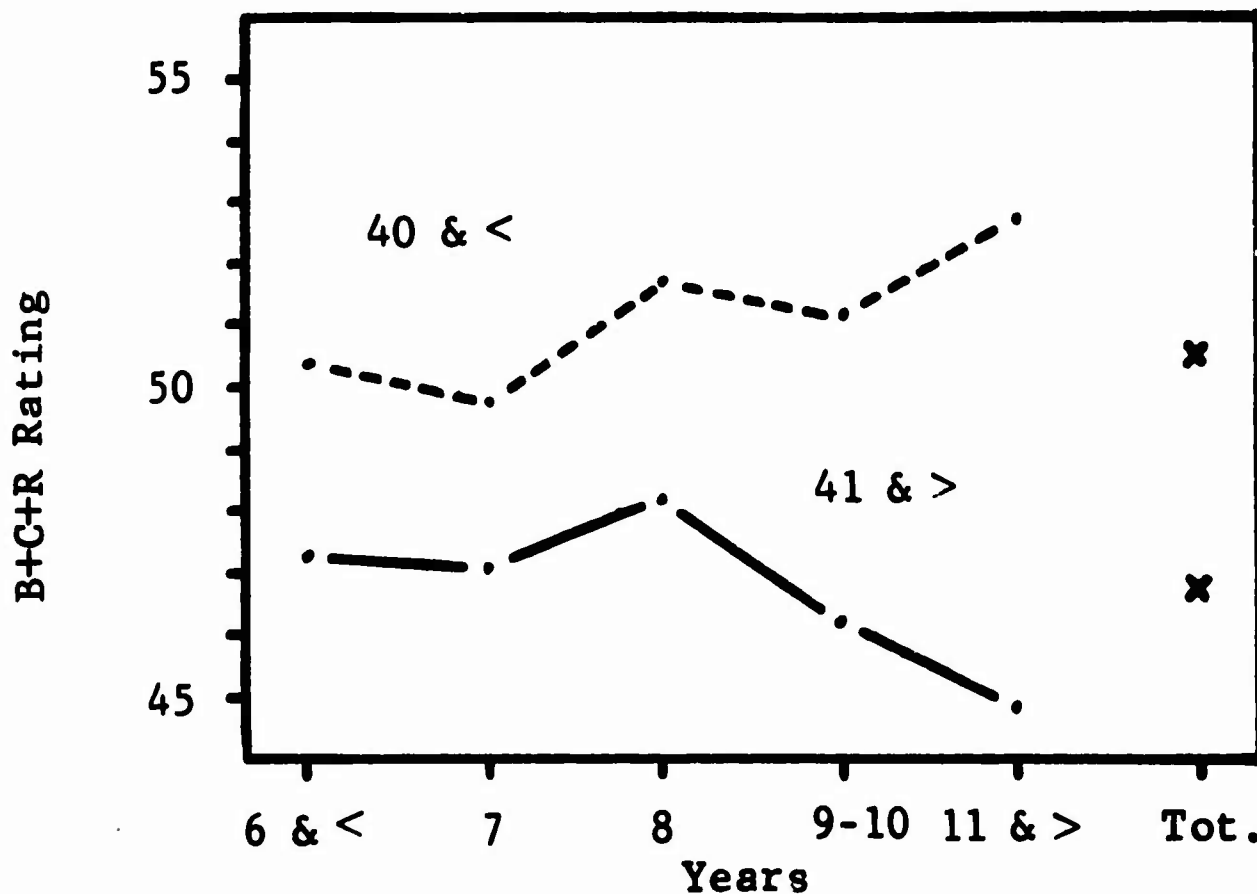


FIGURE 2. Means of the B+C+R Ratings for "Older" vs. "Younger" Radar ATCSs of Different Experience Groups.

variance" and other treatments. Other methods were therefore employed.

Figure 2 presents the plotted means of the composite B+C+R ratings by length-of-experience groups for dichotomized groups of controllers aged "40 and less" and "41 and older." A comparison of the data for the two groups reveals a higher mean rating for the younger controllers of every experience level. The smaller differences are between the younger and older ATCSs of the two least experienced groups. For each succeeding experience category, the plotted means become increasingly more divergent with the greatest differences being between the younger and older controllers of the most experienced groups.

Similar results, which are not graphically depicted in this report, were found for the other four criterion measures. In every instance, the younger controllers within every experience group were characterized by having a higher average rating. Yet only one difference between the younger and older ATCSs proved to be statistically significant; it involved the "C" supervisory ratings of journeymen who had "9-to-10" years of experience.

These findings, supplemented by those of corresponding analyses in which experience was dichotomized, tend to indicate the presence of very moderate and nonsignificant interaction effects. For journeymen controllers younger than 41, job performance ratings (of the type used in this study) generally tend to improve with length of experience in ATC work. This does not appear to be true of the older group of ATCSs.

IV. Discussion

The finding of statistically significant and negative relationships between chronological age and performance ratings is not without precedent. Trites and Cobb^{1,2} reported similar findings in their 1-to-4-year follow-up study of several samples of ATCS trainees. Based on training-entry age, they found that the older recruits—particularly those over 40—were more apt either to fail the initial 8-week training course or to pass with only marginal grades. More importantly, their analysis of post-training data indicated that the older individuals were much more likely to: either leave or be separated from the FAA; transfer to another type of work;

or be reported by their supervisors (unofficially and for research purposes only) as undesirable, potentially hazardous, or less than fully satisfactory in the performance of duties.

The present study concerned the analysis of age, experience, and performance data for journeymen Radar ATCSs of four of the FAA's 21 Air Route Traffic Control Centers (ARTCCs). Despite the fact that more than 82 per cent of the 568 controllers comprising the sample were less than 41 years old and had less than 10 years of ATC experience, the study has nevertheless yielded an appreciable amount of valuable information.

Assuming that the sample is representative, one would conclude that only a very small proportion of the journeymen ATCSs of the 21 ARTCCs are over 40 years of age and/or possess tenure of more than 10 years. However, this does not warrant a summary dismissal of the issue concerning age and experience. On the contrary, it brings into focus the implications of a rather paradoxical situation stemming from the fact that technological advances have permitted the consolidation of several ARTCCs since 1950. The entire air-route control system formerly embodied 32 Center facilities. Fewer controllers have been needed to man the remaining 21 Centers. Some transfers and reassignments have been unavoidable, but the consolidation program has been phased over several years during which the required reduction in manpower has been accomplished primarily through normal attrition of personnel supplemented by a drastic curtailment in the recruitment of controller trainees. Based on the sample, it can be estimated that about 80 per cent of all present-day journeymen air route controllers probably entered the FAA during the 4-year period 1956 through 1959 and that over 70 per cent are between 28 and 35 years old. Inasmuch as recruiting inputs have remained relatively low over a long period of time and due to the fact that the period of rapid development and expansion is past history, promotional opportunities may not be as great as in the past. In fact, these controllers will probably constitute the major portion of the ARTCC journeyman population for many years. However, en masse increments in age and experience will obviously characterize this large bloc of controllers. Excluding a consideration of possible changes in

the system and in staffing policies, it is not unreasonable to predict an approximate mean age of 40 and an average tenure of about 15 years for the Air Route Journeyman ATCS population for the year 1972.

A determination of the reasons as to why the older groups of controllers tend to receive the lower ratings would demand additional research. To what extent might the lower ratings be attributable to physiological aging? Do the chronologically older ATCSs generally have lower-level aptitudes and abilities? Are differences in motivation involved? These represent but a few of the many questions bearing upon the complexity of the problem.

It should be emphasized that the findings emerging from the present study are based on experimentally derived ratings of job performance which were collected at an arbitrarily chosen point in time for controllers representing only a portion of the ARTCC journeyman radar ATCS population. Further, the study afforded no evidence regarding the true reliability of these experimental ratings which were collected on an anonymous basis for research purposes only. In terms of the official and periodic proficiency evaluations, all controllers of the sample had been considered satisfactory.

It is also possible that the ratings have been biased by attitudes regarding age. On the other hand, the older ATCSs may indeed be less proficient than their younger colleagues. Length of experience, when considered independently of age, was found to be negligibly related to rating level. Even though the study failed to reveal any significant interaction effects of age and experience, consistent trends in the results indicated progressively higher mean ratings extending from the lesser to the more experienced groups of controllers who were less than 41 years of age. For ATCSs aged 41 and older, the mean

ratings of the more experienced groups were lower than those of the less experienced groups.

Since completion of this study in which experimentally derived ratings served as criteria, a new appraisal program for all FAA employees has been instituted. This new program involves the use of a detailed evaluation format, designated as the "Employee Appraisal Record" or EAR Form 3693. All employees have not yet been evaluated by this newly implemented method. However, copies of Form 3693 were made available to CAMI researchers for over 300 of the ATCSs involved in the present study. The results of a preliminary analysis, based on data which have been extracted from Part IV of the EAR and coded for quantification, are in general agreement with the findings presented in this report. In other words, the older ATCSs tend to receive the lower ratings and length of experience does not appear to be a significant factor. These findings are also in general agreement with those previously reported by Trites and Cobb.

The present study represents but one of a series of investigations concerning the relationships of performance versus age and/or experience. Much of this additional research is being directed toward identification of the factors underlying these relationships.

REFERENCES

1. TRITES, D. K., and COBB, B. B.: Problems in Air Traffic Management: III. Implications of Training-entry Age for Training and Job Performance of Air Traffic Control Specialists. *Aerospace Medicine*, 35:330, 1964.
2. TRITES, D. K., MILLER, C. M., and COBB, B. B.: Problems in Air Traffic Management: VII. Job and Training Performance of Air Traffic Control Specialists—Measurement, Structure, and Prediction. *Aerospace Medicine*, 36:1131, 1965.